Investigating differences between cirrus optical depth retrievals between CALIOP V3 and MODIS observations

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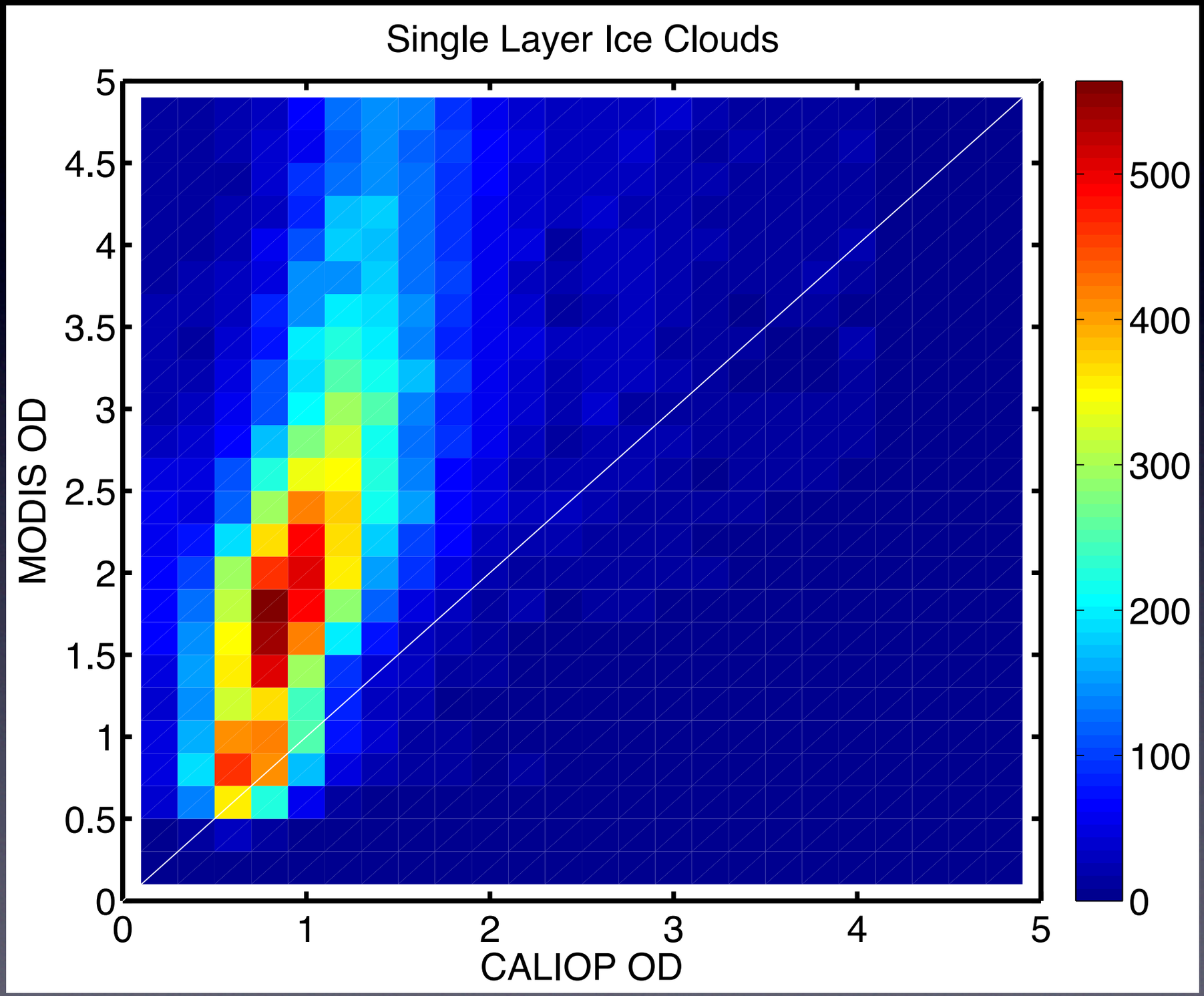
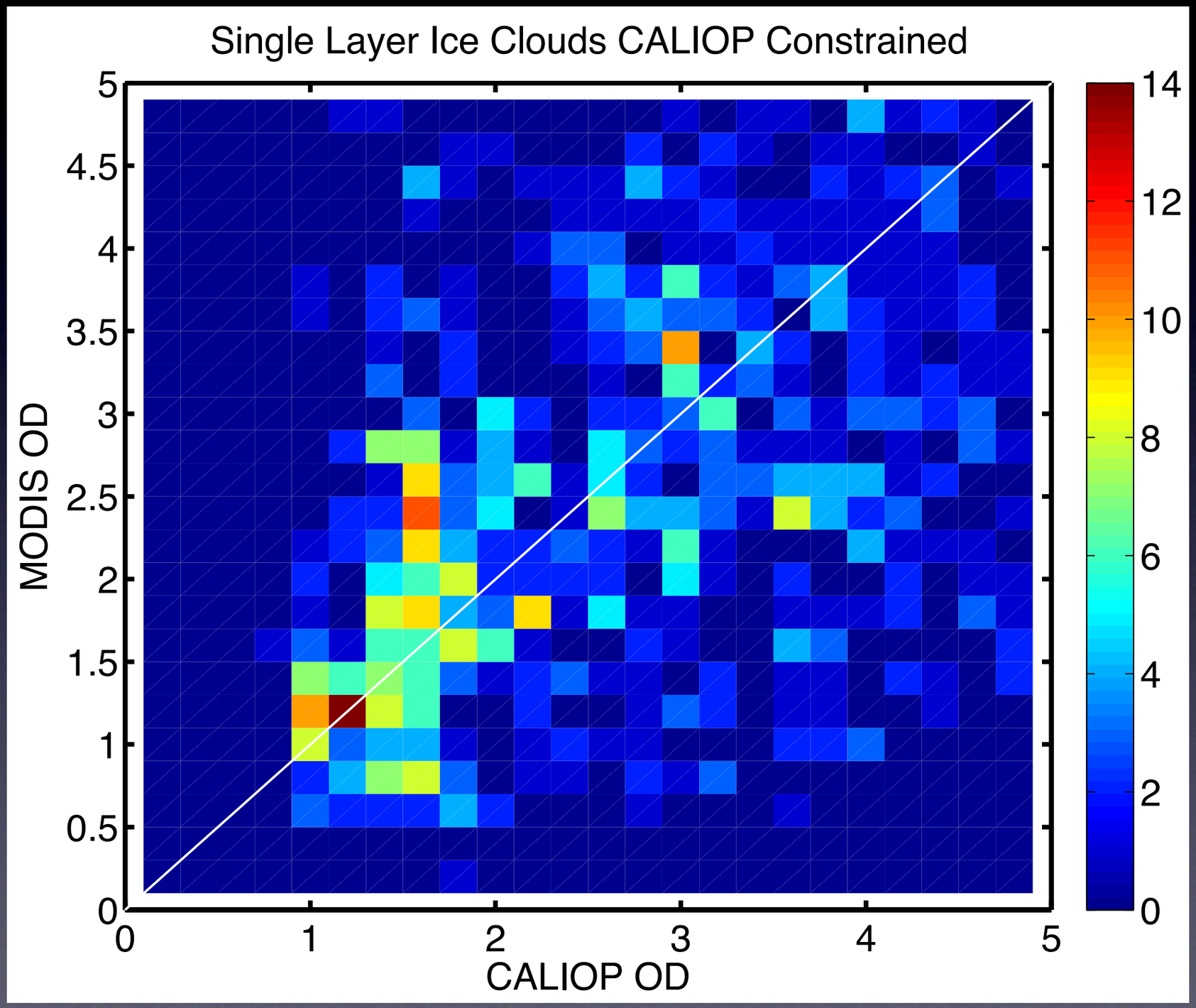
What Was Compared

- 4 months of collocated daytime CALIOP and MODIS cirrus optical depths (MODIS C5 and CALIOP V3)
- Single layer, CALIOP non-opaque
- Non-Polar ocean (<60 deg)
- Phase determined by CALIOP V3 phase retrieval

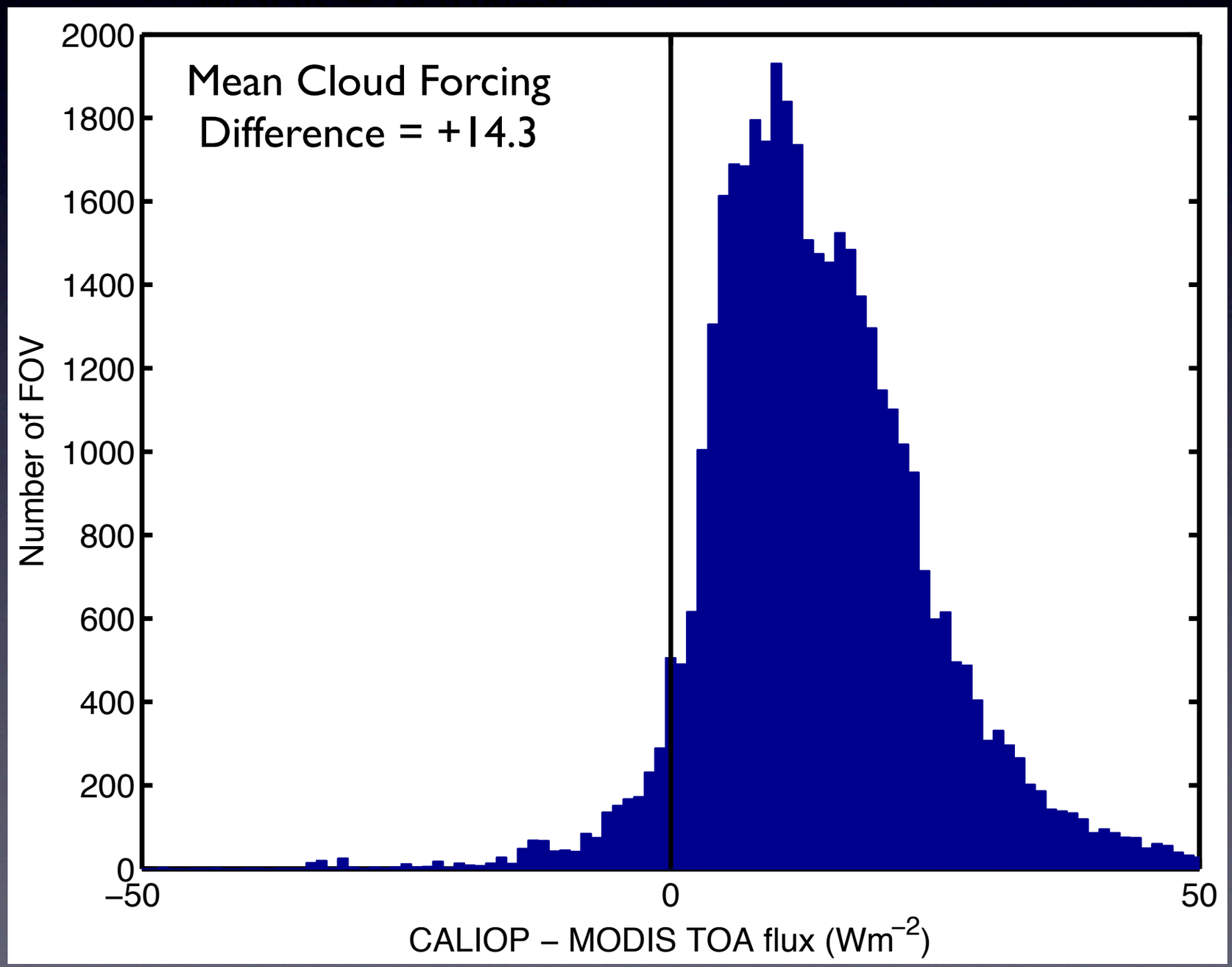
MODIS vs CALIOP OD



MODIS vs CALIOP OD



IR Cloud Forcing Difference Feb 2007

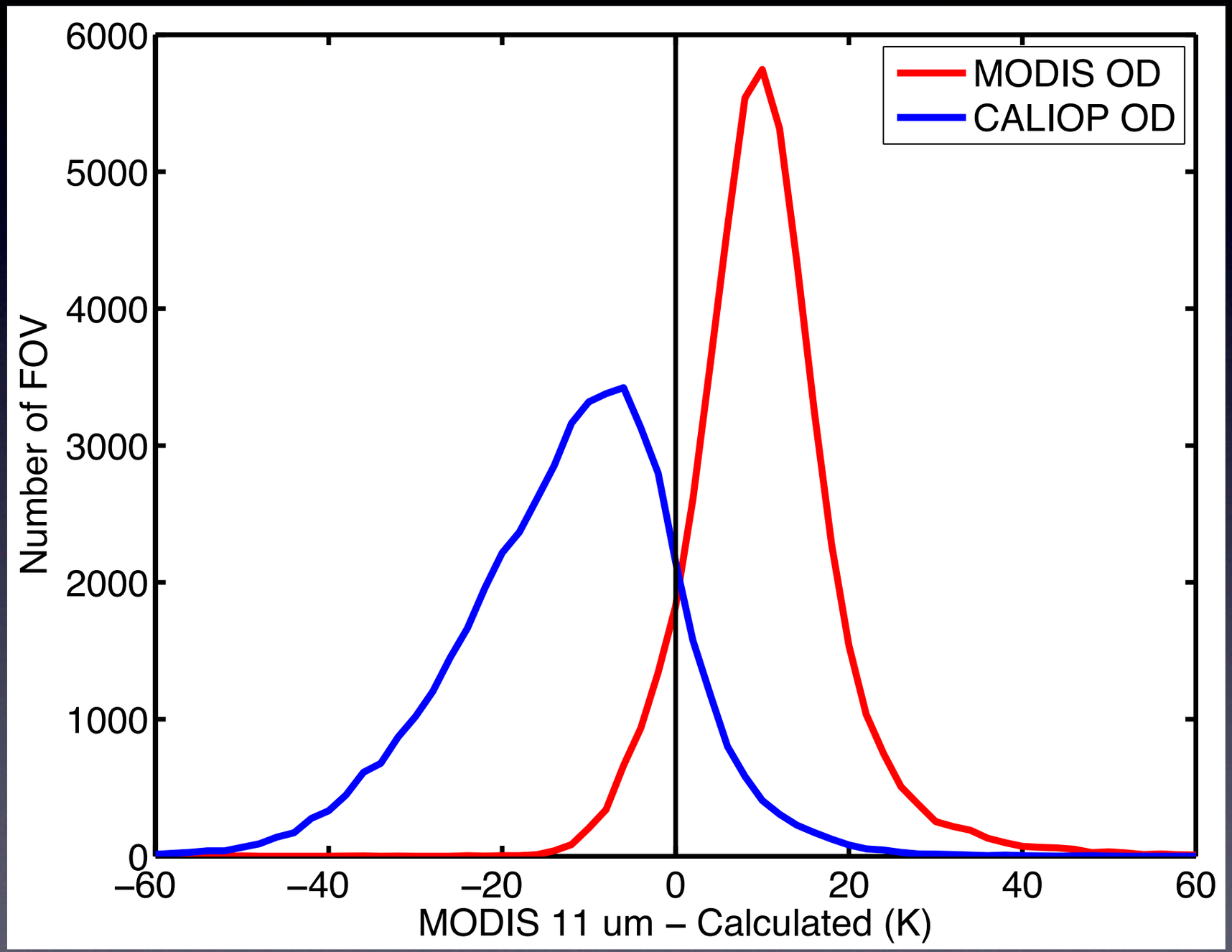


IR Radiative Closure

- Model: LBRTM/DISORT (LBLDIS)
- Ping et al. scattering calculations
- Surface/Thermodynamic profile: GDAS
- Cloud boundaries and phase: CALIOP
- Cloud effective radius: MODIS
- Variable: MODIS/CALIOP layer OD

IR Closure

Unconstrained



Bias Hypothesis

- MODIS
  - Uncertainties in the single-scatter calculations used in the OD retrieval (asymmetry parameter)
- CALIOP
  - Multiple scattering
- Non-uniform cloud optical properties

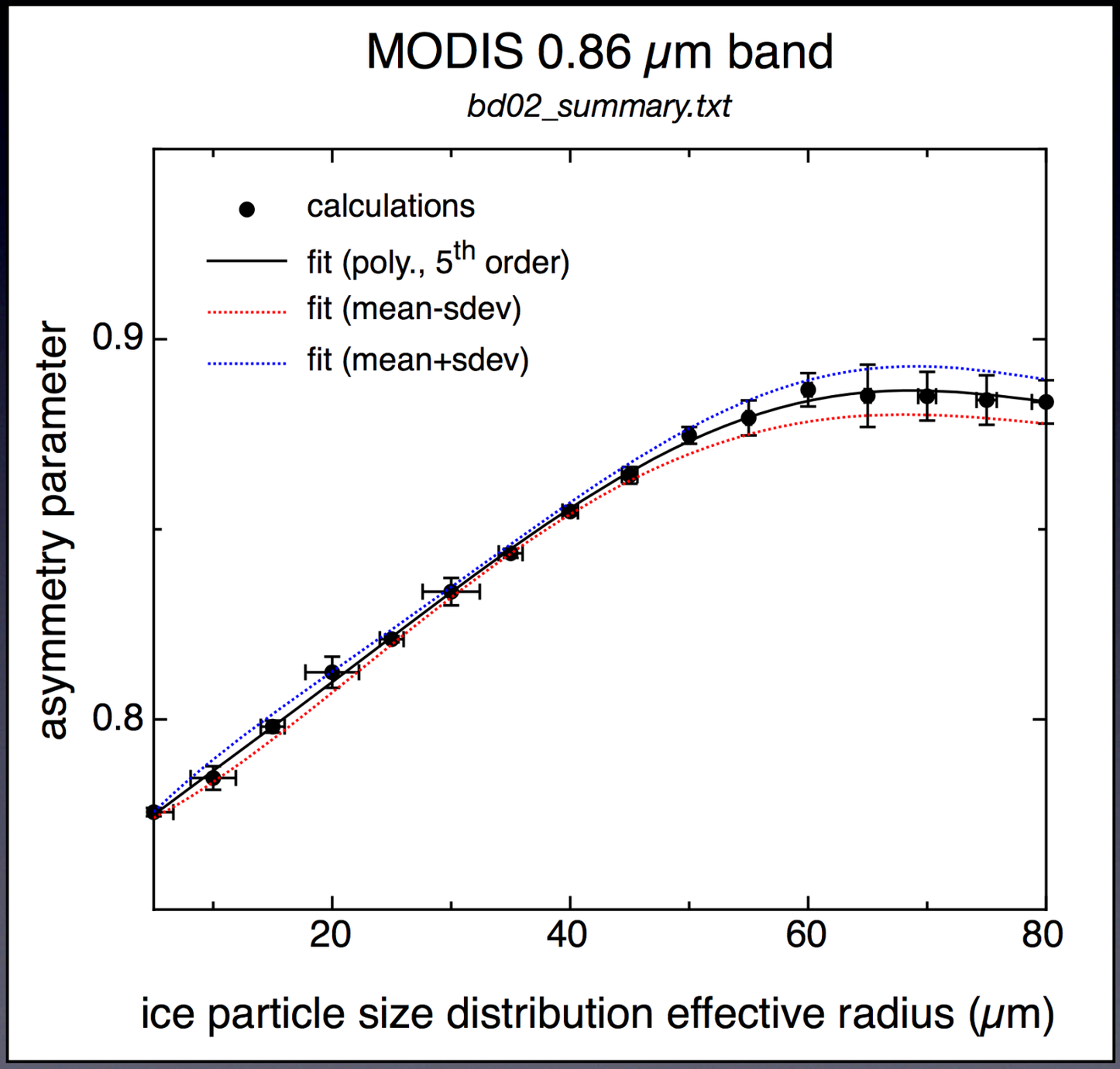
MODIS Scattering Properties

- To first order the MODIS retrieval of optical depth is:

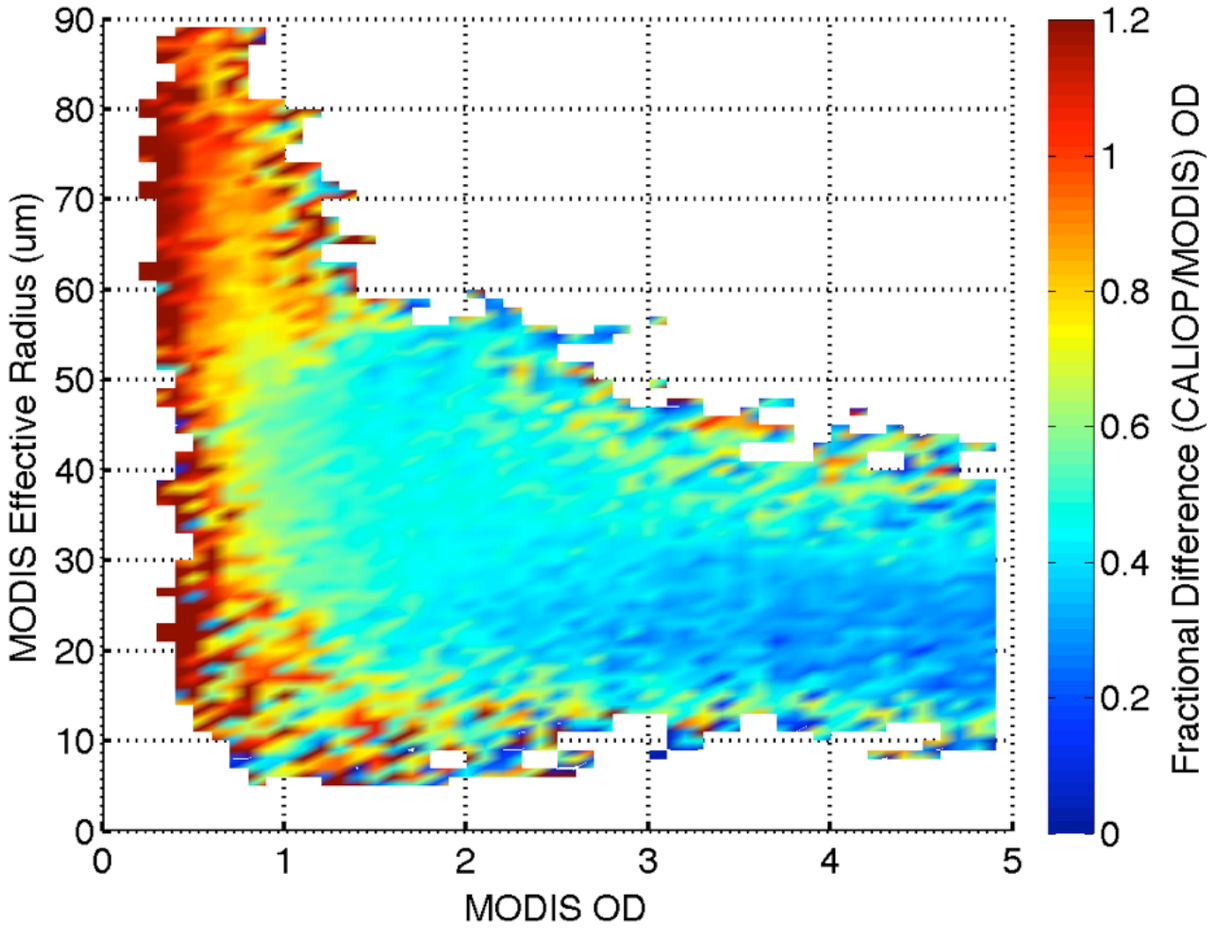
$$R_\nu = (1 - g) \times \tau$$

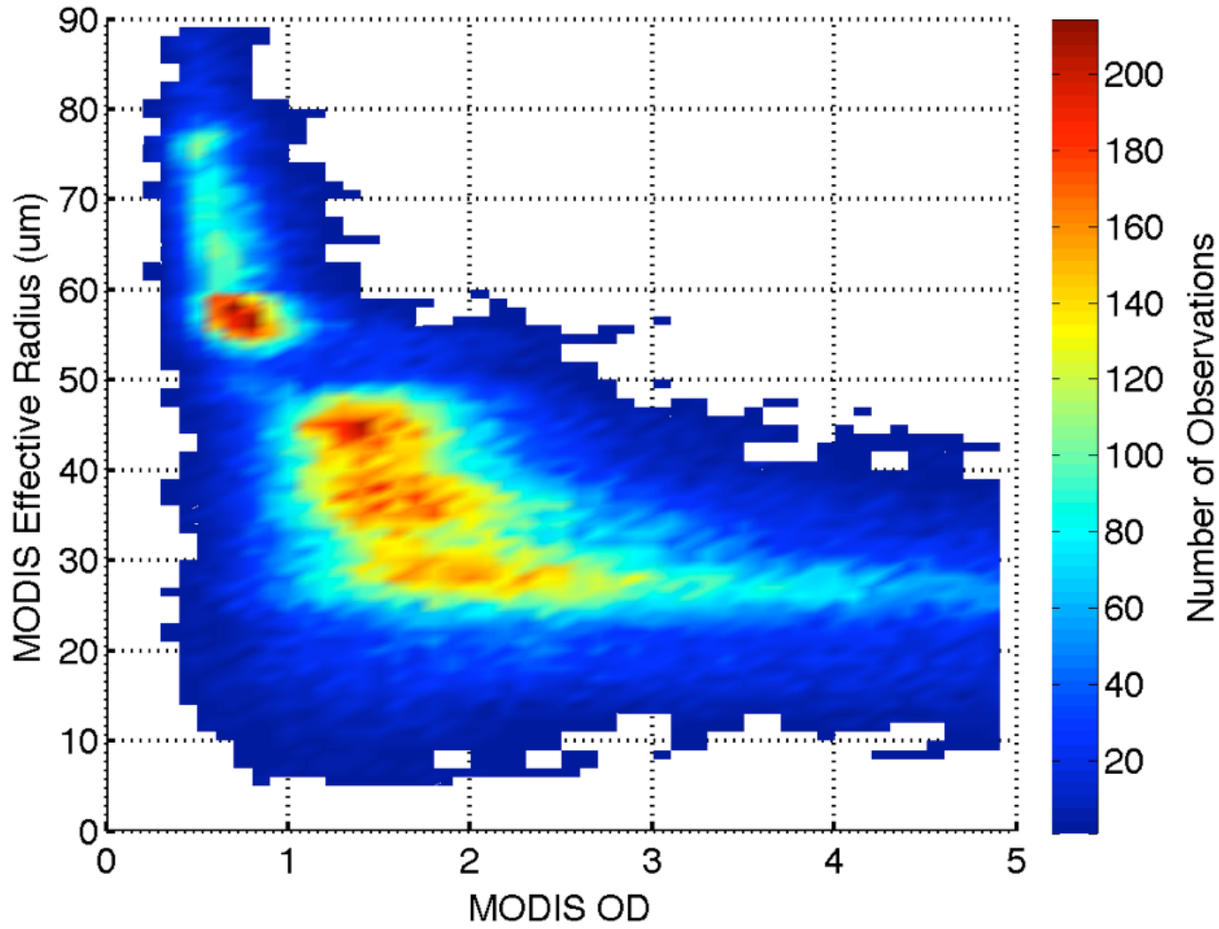
- For ice, g is determined by relating MODIS spectral observations to theoretical single scatter calculations
- Question: Are these calculations representative of real ice crystals?

0.86 μm MODIS C5 g vs. r_e

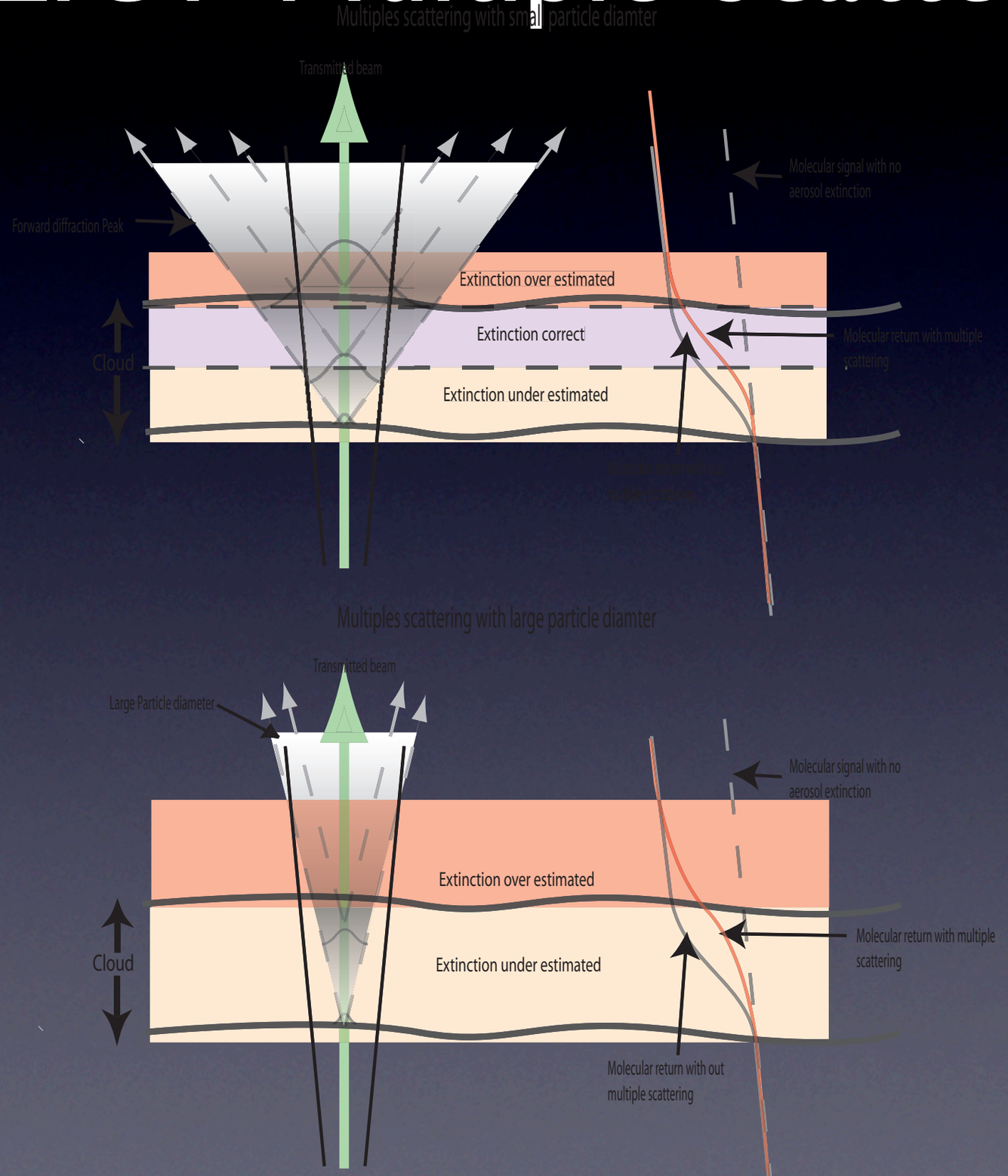


MODIS Retrieval Space





CALIOP Multiple Scattering



Conclusions

- A factor of two difference was found between MODIS and CALIOP retrieved OD for thin cirrus (OD <3)
- IR radiative closure study concluded neither MODIS or CALIOP OD agree with measured TOA MODIS 11 um BT
- Possible sources of uncertainty have been identified in both CALIOP and MODIS
- A community effort is necessary to understand and resolve the OD differences